

NUFLO™

# Orifice Plates & Orifice Plate Sealing Units

## Specifications

Two basic styles of Orifice Plates are available: Type 500 Universal for use in Orifice Fittings and Ring-Joint Plate Holders, and Type 520 Paddle Type for use in Orifice Flanges. Specific tolerances which apply to all NuFlo™ Orifice Plates are as follows:

- Edges: Square and sharp, will not reflect a beam of light when viewed without magnification.
- Finish: 20 micro-inch roughness
- Flatness: Flat within 0.010-in., per inch of dam height (dam height = pipe diameter minus orifice diameter, divided by 2)
- Bore: Orifice bore tolerance in strict accordance with AGA Gas Measurement Committee Report latest edition, ASME Fluid Meters Committee Report and Measurement Canada.
- Design: Normal stocked items are the standard design used in all industries. Special designs are available on request.
- Sizes: Orifice Plates have been furnished in line sizes from 1/2-in. to 36-in. All standard line sizes, 2-in. to 8-in. are available from stock. Larger plates up to 60-in. line size available upon request.
- Optional: Vent or drain holes. Available at time of order. Gasket finished plates are also available at time of order.



## Universal Orifice Plates

### Type 500

Universal Size Orifice Plates are a standard used in many industries. They can be used in Plate Holders with NuFlo™, Daniel and Superior Orifice Fittings. The universal size is the most economic style of plate available. Three types of sealing units are used with Nuflo™ Type 500 Orifice Plates. These are the 'DS' Dual Seal, which is removable up through 10-in. size and bonded to the plate in larger sizes, the 'TS', Teflon® Seal, available in 1-1/2-in. to 16-in. sizes, and the 'MS', Metal Seal available in the 1-1/2-in. to 12-in. sizes. The 'TS' and 'MS' units are removable in all sizes.

All dimensions in inches. When ordering, please specify:

- Type Number
- Line Size
- Dimension "A", if not listed
- Material
- Quantity
- Required Orifice Bore
- Type Seal

### Type 500 Universal Plates for use in RTJ Holders (no seal units included)

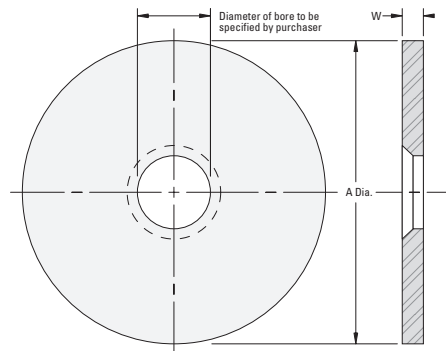
Line Size	Plate O.D.	Plate Thickness
	A	B
12	12.593	1/4
14	14.000	1/4
16	16.000	3/8
18	18.000	3/8
20	20.000	3/8
24	24.000	3/8
26	26.000	3/8
30	30.000	1/2

Line Size	Plate O.D.	Plate Thickness	Blank Weight (lbs)
	A	W	
3/4	1.125	1/8	0.06*
1	1.312	1/8	0.06
1-1/2	2.000	1/8	0.11*
2	2.437	1/8	0.17
2-1/2	2.812	1/8	0.25
3	3.437	1/8	0.34
4	4.406	1/8	0.55
6	6.437	1/8	1.18
8	8.437	1/4	4.06
10	10.687	1/4	6.41
12	13.079	1/4	9.61
16	16.563	3/8	23.20
20	20.563	3/8	39.16

All dimensions in inches.



**Type 500 Orifice Plate**



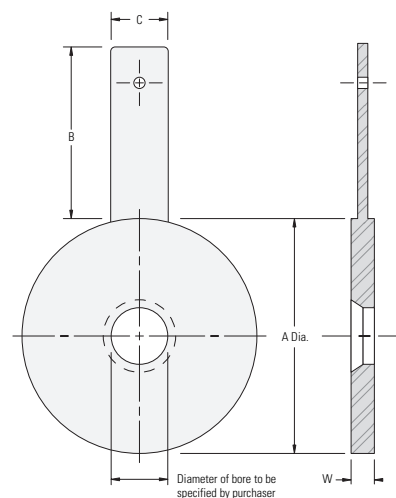
### Paddle Type Orifice Plates Type 520

Nuflo™ Paddle Type Orifice Plates are normally used with Orifice Flange Unions. The outer diameters are manufactured from uniform circular discs. This results in a high degree of concentricity of the orifice bore and the plate outer diameter. The plates are sanded on special machines to a prescribed finish. Plates with popular bore sizes are stocked continuously. Each plate is stamped on its handle with line size, flange rating, orifice bore and plate material. Cameron maintains a stock in

types 304 and 316 Stainless Steels in standard thicknesses. Other sizes, thickness and materials are available upon request. Diameters of holes in Paddle Plate Handles are as follows:

Plate Size	Hole Diameter
1/2 thru 2	1/4
2-1/2 thru 12	3/8
14 thru 24	1/2
26 and larger	3/4

All dimensions in inches.



Line Size	125 lbs. & 150 lbs.	250 lbs. & 300 lbs.	400 lbs.	600 lbs.	900 lbs.	1500 lbs.	2500 lbs.	For all Pressure Ratings 125 to 1500 lbs. ANSI		
	ANSI A	ANSI A	ANSI A	ANSI A	ANSI A	ANSI A	ANSI A	B	C	W*
1/2	1-7/8	2-1/8	2-1/8	2-1/8	2-1/2	2-1/2	2-3/4	4	1	1/8
3/4	2-1/4	2-5/8	2-5/8	2-5/8	2-3/4	2-3/4	3	4	1	1/8
1	2-5/8	2-7/8	2-7/8	2-7/8	3-1/8	3-1/8	3-3/8	4	1	1/8
1-1/4	3	3-1/4	3-1/4	3-1/4	3-1/2	3-1/2	4-1/8	4	1	1/8
1-1/2	3-3/8	3-3/4	3-3/4	3-3/4	3-7/8	3-7/8	4-5/8	4	1	1/8
2	4-1/8	4-3/8	4-3/8	4-3/8	5-5/8	5-5/8	5-3/4	4	1	1/8
2-1/2	4-7/8	5-1/8	5-1/8	5-1/8	6-1/2	6-1/2	6-5/8	4	1-1/4	1/8
3	5-3/8	5-7/8	5-7/8	5-7/8	6-5/8	6-7/8	7-3/4	4	1-1/4	1/8
4	6-7/8	7-1/8	7	7-5/8	8-1/8	8-1/4	9-1/4	4	1-1/4	1/8
5	7-3/4	8-1/2	8-3/8	9-1/2	9-3/4	10	11	5	1-1/2	1/8
6	8-3/4	9-7/8	9-3/4	10-1/2	11-3/8	11-1/8	12-1/2	5	1-1/2	1/8
8	11	12-1/8	12	12-5/8	14-1/8	13-7/8	15-1/4	5	1-1/2	1/8
10	13-3/8	14-1/4	14-1/8	15-3/4	17-1/8	17-1/8	18-3/4	6	1-1/2	1/4
12	16-1/8	16-5/8	16-1/2	18	19-5/8	20-1/2	21-5/8	6	1-1/2	1/4
14	17-3/4	19-1/8	19	19-3/8	20-1/2	22-3/4	n/a	6	1-1/2	1/4
16	20-1/4	21-1/4	21-1/8	22-1/4	22-5/8	25-1/4	n/a	6	1-1/2	3/8
18	21-1/2	23-3/8	23-1/4	24	25	27-5/8	n/a	6	1-1/2	3/8
20	23-3/4	25-5/8	25-3/8	26-3/4	27-3/8	29-5/8	n/a	6	1-1/2	3/8
22	26	27-3/4	27-1/2	28-7/8	n/a	n/a	n/a	6	1-1/2	3/8
24	28-1/8	30-3/8	30-1/8	31	32-7/8	35-1/2	n/a	6	1-1/2	3/8
30	34-5/8	37-3/8	37-1/4	38-1/8	n/a	n/a	n/a	6	1-1/2	1/2
36	41-1/8	43-7/8	43-7/8	44-3/8	n/a	n/a	n/a	6	1-1/2	1/2

All dimensions in inches.

When ordering, please specify: • Type Number, • Size, Flange Series, • Dimension "A", if not as listed, • Material, • Quantity, • Required Orifice Bore

### Special Profile Orifice Bores Bore and Bevel

The bore and bevel is the standard method of limiting the plate edge thickness. The bevel is machined to the desired edge thickness. Unless otherwise specified, plates will be beveled to the current accepted AGA standards.

### Bore and Counterbore

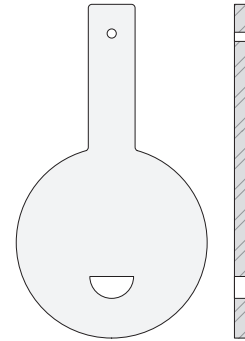
The bore and counterbore is a special method to limit the plate edge thickness. Instead of beveling, the plate is counter-bored to the desired edge thickness.

### Segmental

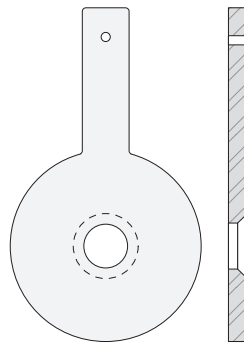
Segmentally bored orifice plates are provided for measurement where solids are entrained in a gas or liquid flow stream. The circular portion of the bore is inscribed within a circle which is normally 98% of the pipe diameter. The segmental opening may be placed either at the top or bottom of the pipe. Industries using these bores include sewage treatment, steel, chemical, water conditioning, paper and petrochemical.

### Quarter-Round

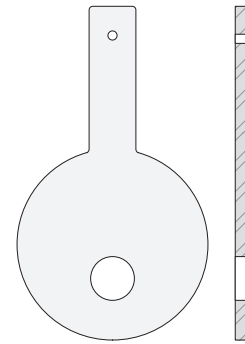
The Quarter-Round, or Quadrant bore, is an orifice with the inlet edge rounded. The radius of the quarter-circle bore is a function of the orifice-to-pipe ratio ( $d/D$ ). Thickness at the throat is equal to the radius. This bore is specifically designed for fluids of high viscosity, such as heavy crudes, syrups, and slurries. Quarter-Round bores are recommended for viscous flows having Reynolds Numbers below 100,000.



**Segmental**



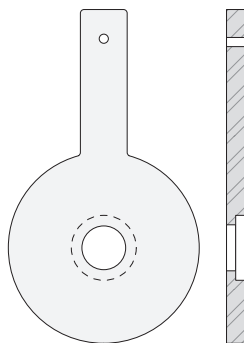
**Bore and Bevel**



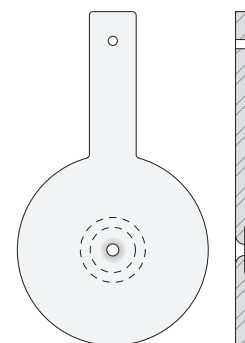
**Eccentric**

### Eccentric

Eccentrically bored orifice plates are plates with the orifice off-center, or eccentric, as opposed to concentric. The bore of the eccentric, orifice normally is inscribed in a circle which is 98% of the pipe diameter, so that solids or slurries may pass through. Eccentric orifice plates are used in many industries including heavy and light chemicals, steel, paper, atomic and petrochemicals.



**Bore and Counterbore**



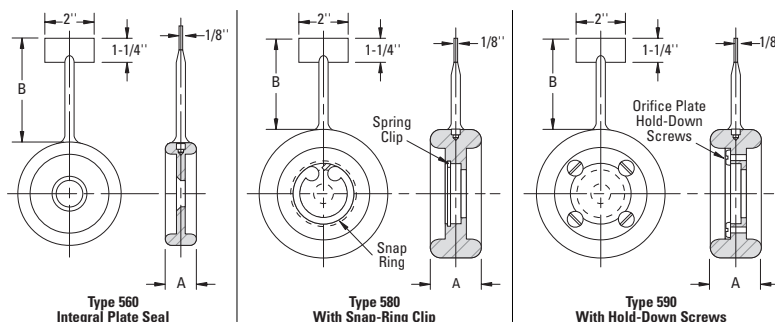
**Quarter-Round**

### Ring Joint Orifice Plate Holders

NuFlo™ Ring-Joint Orifice Plate Holders are fitted with Type 500 Orifice Plates and are used with Ring-Joint Orifice Flanges. The Oval Form is standard. Octagonal rings are also available on request. Type 580 Plate Holders are equipped with a steel snap-ring which clamps orifice plate snugly in place. Type 560 Plate holders are a one piece Integral Plate seal. Type 590 Plate Holders have hold down screws to keep the plate in the holder.

Orifice Plates are not included with Plate Holders and must be ordered separately. The Plate Holders are available in mild steel from 1-1/2-in. size and up. Type 304 and Type 316 Stainless Steel Plate Holders are offered in all sizes. Dimensions are for 12-in. and larger, Type 500 Orifice Plates for use in RTJ Holders.

Line Size	Plate O.D. A	Plate Thickness B
12	12.593	1/4
14	14.000	1/4
16	16.000	3/8
18	18.000	3/8
20	20.000	3/8
24	24.000	3/8
26	26.000	3/8
30	30.000	1/2



Line Size	300 - 600 lbs. ANSI				900 lbs. ANSI				1500 lbs. ANSI				2500 lbs. ANSI			
	API Ring #	A	B	Approx. Gap*	API Ring #	A	B	Approx. Gap*	API Ring #	A	B	Approx. Gap*	API Ring #	A	B	Approx. Gap*
1/2	R-11	29/32	4-1/4	19/32	R-12	1	4-1/4	19/32	R-12	1	4-1/4	19/32	R-13	1	4-1/4	19/32
3/4	R-13	1	4-1/4	19/32	R-14	1	4-1/4	19/32	R-14	1	4-1/4	19/32	R-16	1	4-1/4	19/32
1	R-16	1	4-1/4	19/32	R-16	1	4-1/4	19/32	R-16	1	4-1/4	19/32	R-18	1	4-1/4	19/32
1-1/2	R-20	1	4-1/4	19/32	R-20	1	4-1/4	19/32	R-20	1	4-1/4	19/32	R-23	1-1/16	5-1/4	1/2
2	R-23	1-1/16	4-1/4	19/32	R-24	1-1/16	5-1/4	5/8	R-24	1-1/16	5-1/4	1/2	R-26	1-1/16	5-1/4	1/2
2-1/2	R-26	1-1/16	5-1/4	19/32	R-27	1-1/16	5-1/4	5/8	R-27	1-1/16	5-1/4	1/2	R-28	1-13/16	5-1/4	9/16
3	R-31	1-1/16	5-1/4	19/32	R-31	1-1/16	5-1/4	17/32	R-35	1-1/16	5-1/4	1/2	R-32	1-3/16	6-1/4	9/16
3-1/2	R-34	1-1/16	4-1/4	19/32	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4	R-37	1-1/16	5-1/4	19/32	R-37	1-1/16	5-1/4	17/32	R-39	1-1/16	5-1/4	1/2	R-38	1-5/16	6-1/4	19/32
5	R-41	1-1/16	6-1/4	19/32	R-41	1-1/16	6-1/4	17/32	R-44	1-1/16	6-1/4	1/2	R-42	1-7/16	7-1/4	19/32
6	R-45	1-1/16	6-1/4	19/32	R-45	1-1/16	6-1/4	17/32	R-46	1-3/16	6-1/4	9/16	R-47	1-7/16	7-1/4	19/32
8	R-49	1-1/16	6-1/4	19/32	R-49	1-1/16	6-1/4	17/32	R-50	1-35/16	6-1/4	9/32	R-51	1-9/16	8-1/4	5/8
10	R-53	1-3/16	7-1/4	23/32	R-53	1-3/16	7-1/4	21/32	R-54	1-7/16	7-1/4	23/32	R-55	2	8-1/4	1-1/16
12	R-57	1-3/16	7-1/4	23/32	R-57	1-3/16	7-1/4	21/32	R-58	1-11/16	8-1/4	3/4	R-60	2-1/8	9-1/4	7/8
14	R-61	1-3/16	7-1/4	23/32	R-62	1-7/16	7-1/4	23/32	R-63	1-7/8	8-1/4	25/32	n/a	n/a	n/a	n/a
16	R-65	1-5/16	7-1/4	23/32	R-66	1-9/16	7-1/4	27/32	R-67	2-1/8	9-1/4	1	n/a	n/a	n/a	n/a
18	R-69	1-5/16	7-1/4	23/32	R-70	1-11/16	7-1/4	3/4	R-71	2-1/8	9-1/4	1	n/a	n/a	n/a	n/a
20	R-73	1-3/8	7-1/4	23/32	R-74	1-9/16	7-1/4	3/4	R-75	2-1/8	10-1/4	7/8	n/a	n/a	n/a	n/a
24	R-77	1-7/16	7-1/4	13/16	R-78	1-7/8	9-1/4	25/32	R-79	2-5/16	11-1/4	1	n/a	n/a	n/a	n/a

All dimensions in inches.

NOTE: Type 560 Plate Holders are available in all sizes and Ring Numbers. Type 580 Plate Holders are available in all API Ring Numbers from 1-1/2-in. and up.

Type 590 Plate holders are available in 2-in. size and up in all Ring Numbers except 2-in. R-23 and 2-1/2-in. R-26. Other sizes, materials, ANSI and special flange ratings are available on special order. When ordering, please specify: • Type number, • Size, • Ring number or ANSI Flange Pressure Rating, • Material, • Quantity,

• Required orifice bore (Type 560).

\* Approximate distance between flanges.

† On Type 560 Holders in 2-in. through 8-in. sizes have 1/4-in. thick plates as standard, add 1/8-in. to "Approx. Gap" dimensions.

## Orifice Plate Sealing Units Removable Seal

Constructed of 70-80 durometer nitrile rubber, this seal provides for a positive seal on four rubber to metal surfaces. Both faces of the universal orifice plate are sealed against both seats of the orifice fitting.

The removable seal is vulcanized to the orifice plate in 12-in. and larger sizes. The hycar removable seal is specially bonded directly to the orifice plate at the factory and shipped as a single unit.

Removable seals are designed for use in pressure ratings up to ANSI 600 lbs. and have an allowable temperature range of -20°F to +275°F.

## Orifice Plate Alloys Available

Stainless, High Temperature and Special Alloys

304	347	Hastelloy B, C
304 L	410	Hastelloy X, W
310	416	Inco 600
316	430	Inco 625
316 L	A516-7N	Stellite Overlay
317	Monel	Titanium
321	K-Monel	Tanalum

Other material available on request.

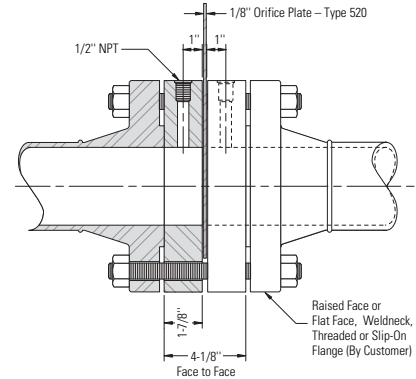
## Teflon® Seal

Teflon®, an excellent corrosive resistant material, is used in this seal. Higher temperature applications are allowable with the Teflon® seal. Teflon® seals are widely used in acids, aggressive, base compounds liquefied air products, and other chemicals from -65°F to +450°F. An inlet retainer fits around the universal plate and an outlet retainer ring has stainless steel clasps to close the assembly. The dimensional stack up of the unit allows for compression to seal the plate. Maximum pressure rating-ANSI 2500.

## Orifice Holding Blocks

Cameron manufactures orifice holding blocks in Teflon®, PVC and other materials suitable for use in severe or caustic applications. Line sizes offered are from 1-in. up to 12-in., and these orifice holding blocks are used between 150 lbs. ANSI-rated flanges. Flange taps are standard in all sizes, and the tap hole ID depends on line size.

For additional information or prices, contact Cameron's Measurement Systems Division's sales department. When ordering please specify nominal line size, line ID, gaskets thickness and material desired.



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Formerly: NuFlo Measurement Systems • Barton Instrument Systems • Caldon, Inc.

NORTH AMERICA

**1.800.654.3760**

ms-us@c-a-m.com

ASIA PACIFIC

**65.6737.0444**

ms-asiapacific@c-a-m.com

EUROPE, MIDDLE EAST & AFRICA

**44.1243.826741**

ms-uk@c-a-m.com

**USA:** Houston, TX • Corpus Christi, TX • Kilgore, TX • Odessa, TX • Dallas, TX • Tulsa, OK • Duncan, OK • Denver, CO • Bakersfield, CA • Shreveport, LA • Lafayette, LA • Houma, LA • Pittsburgh, PA • Laurel, MS • Dunbar, WV • Casper, WY • Charleston, WV

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**HOUSTON HEAD OFFICE: 281.582.9500 • www.c-a-m.com/flo**